Montane areas 5

Definition and location of montane areas

5.1 Definition of montane areas

Montane areas are defined here as the land above the natural tree-line, which is the climatically determined upper limit of tree growth. This area is also referred to as the alpine zone (Horsfield & Thompson 1996). In England this is generally found above 600 m, although the precise altitude of the potential tree-limit varies across the country and depends on local variations in temperature, shelter and humidity (Pearsall 1950; Ratcliffe 1977; Ratcliffe & Thompson 1988). In the Lake District, for example, the climatic tree-line is estimated to lie at about 535 m, while in the Brecon Beacons and Cairngorms it lies at about 640 m (Ratcliffe 1991). The tree-line is difficult to detect in the British Isles because it has been greatly modified by grazing and burning (Ingrouille 1995).

At the upper limits of tree growth there may be a zone of tall scrub, often composed of the same tree species (mainly oak, birch and pine) which dominate the woodland below. The upper limits of this tall scrub may be taken as the boundary between the sub-montane and montane zones, although the distinction between the two zones is often blurred. The two typically merge through a broad band of transitional vegetation which varies in exact altitude even across one mountainside. The transition between sub-montane and montane habitats can be particularly difficult to identify in England, because the limits of tree growth are often only revealed by scattered woody growth on cliff faces (Ratcliffe 1977).

The tall scrub gives way with increasing altitude to shrubs of medium height, of species such as juniper *Juniperus communis* and willows *Salix* spp., and then to dwarf-shrub heath (ericoids). Amongst or in place of ericoid heath are found moss- and lichen-heaths, dwarf-herb communities, sedge- and rush-heaths, and other grass-dominated communities.

5.2 Location and extent of montane areas

The majority of the montane area in Britain occurs in Scotland, but in England montane habitats are found on the highest mountains and hills in the north and west of the country. They occur in the central Lake District fells as well as the North Pennines, the Yorkshire Dales and the Cheviot Hills in Northumberland.

The extent of montane habitats in England is limited and where they occur they are local in their distribution. Along with examples in North Wales, they represent southern outliers in Britain of vegetation communities which are far more widespread and extensive in Scotland. It is estimated that montane heath, mire and grassland in England covers approximately 1,500 ha. For further details of the distribution of particular montane habitats and species in England, see section 5.4 below.

Habitats and species of montane areas

5.3 Why montane areas are important

Montane areas in Britain support a unique flora and fauna (Ratcliffe 1977). British montane habitats represent southern and oceanic outliers of habitats which are more extensive in continental Europe. They show considerable diversity and include several types which are either highly local or apparently absent elsewhere (Ratcliffe & Thompson 1988; Thompson & Brown 1992). For these reasons several plant communities of montane areas are of international significance and this is recognised by their inclusion in Annex 1 of the Habitats Directive (see Table 5.4).

The best examples of British montane habitats are found in Scotland, but English montane habitats are of significance because they represent examples of these communities near the southern-most extremity of their range in Britain. Most of the montane communities occurring in England extend farther south, into Wales. As might be expected from this southerly position, the English montane areas are relatively small in extent, rather fragmented in nature, and limited in terms of the species they contain. Nevertheless, they are still of considerable importance and support species, such as Arctic-alpine plants, which are specific to these conditions.

Yellow marsh saxifrage *Saxifraga hirculus* is threatened throughout its international range and is included in the Habitats Directive (Annex b). The majority of the British population occurs in England (Taylor 1994), where it is found in the North Pennines Natural Area.

Montane areas support many vascular and non-vascular plants and invertebrates that are nationally rare and scarce (Tables 5.1, 5.2 and 5.7). Montane habitats and certain species of these areas are included in the UK Biodiversity Action Plan (UK Biodiversity Group 1998; UK Steering Group 1995).

Montane areas are also valued for their geological and geomorphological interests (5.6.4), as well as their archaeological and historic interests (5.6.5).

5.4 Habitats and species of montane areas, their nature conservation status and distribution

5.4.1 Vascular plants

The plant species of nature conservation significance in montane areas of England are shown in Table 5.1, with their nature conservation status and distribution in upland Natural Areas. Many species of the montane zone, like the grasses and some of the heath plants, have a wide altitudinal distribution and are able to survive in the poor soils and unfavourable conditions of mountain tops. Other species, such as some of the saxifrages *Saxifraga* spp., are found most frequently in montane areas, but also occur further down the hill side. In addition, there are the specialised montane plants, including alpine species and Arctic-alpines, which are rarely or never found outside montane environments and make mountains places of particular interest to botanists (Pearsall 1950). (See Glossary for definitions of alpine, Arctic and Arctic-alpine plant species.)

Many scarce montane plants have a relict distribution (Stewart, Pearman & Preston 1994). Fossil evidence indicates that they were present in the last glacial period at sites in England and Wales which are now far south of their current range. They now grow in habitats such as wind-exposed summits, sheltered and shaded sites where snow accumulates in the winter and lies late into the spring and summer, rock-ledges on cliffs and sides of gullies, and among screes, springs and flushes. Species which can withstand grazing are also found in montane grassland communities.

5.4.2 Bryophytes

Montane areas of England support a range of nationally rare and scarce moss and liverwort species, some of which are restricted to this zone while others have a broad altitudinal range and are more widespread (Table 5.2). There are some species which can be unambiguously regarded as montane or upland, but there are many which are not so easily categorised this way.

Bryophytes can be very specialised in their niche requirements and often their distribution is determined by the distribution of suitable substrates or conditions. Many are associated with rocky situations, such as cliff ledges and crevices, ravines, mountain summits and areas of scree or boulders. These frequently provide moist, base-rich conditions which favour certain species. *Grimmia incurva* for example is principally a montane species but this is probably a reflection of the distribution of acidic rock outcrops. Although very rare, this species does occur in southern, lowland England on artificial substrates such as slate roofs and in churchyards.

5.4.3 Plant communities

The vegetation found at high altitudes in England includes dwarf-shrub heath, moss- and lichen-heath, grassland, mires, tall-herb and fern-dominated communities and low growing juniper and willow scrub. The National Vegetation Classification (NVC, Rodwell 1991, 1992) describes the montane plant communities of Britain. Those occurring in English montane areas are shown in Table 5.4, together with their nature conservation status and distribution in upland Natural Areas of England (Drewitt & Manley 1997).

Some of the montane zone is covered by communities which are more widespread in the sub-montane zone or have developed as a result of grazing and burning. These are discussed further in Chapter 6 Moorland. For example, bilberry *Vaccinium myrtillu*s-wavy hair-grass *Deschampsia flexuosa* heath (NVC community H18) occurs in both the montane and sub-montane zones, naturally and in response to heavy grazing and / or burning. Much of what was the predominantly montane community of stiff sedge *Carex bigelowii*-woolly hair moss *Racomitrium lanuginosum* moss heath (NVC community U10) is now sheep's fescue *Festuca ovina*-common bent *Agrostis capillaris*-heath bedstraw *Galium saxatile* grassland (NVC community U4). This is due to grazing, the consequent enrichment and trampling, and this community is extremely widespread in the sub-montane zone.

5.4.4 Birds

Birds associated with the montane zone in England are shown in Table 5.5, with their current nature conservation status and distribution in upland Natural Areas. Of the small number of bird species which nest or feed in the montane zone of England, only one is confined to it - the dotterel *Charadrius morinellus*.

The total dotterel population is now restricted to around two pairs in the North Pennines. In the nineteenth century and up to about 1860, it is estimated that the total annual breeding population in England was 50-75 pairs in good years (Ratcliffe 1973). Breeding dotterel in England are at the southern edge of their European and global range.

Ptarmigan *Lagopus mutus* would also be confined to the montane zone if they were present, but this species is extinct in England. The reason for their extinction in England is not known but it may have been due to a combination of climate change and over hunting (P. Whitfield, pers comm). It is likely that the species was never common in England. Evidence for its former occurrence is scant, but it seems probable that it formerly bred in the Lake District until the early eighteenth century (MacPherson & Duckworth 1886).

A number of other species nest and feed in the montane zone, but they also breed in the sub-montane zone and overall numbers there are far higher (Table 5.5). The English montane zone is consequently of lower conservation significance for these species when compared with other far more extensive upland habitats.

5.4.5 Invertebrates

Invertebrates of montane areas include beetles, moths, butterflies and spiders, many of which are more numerous or widespread in Scotland and Wales. The beetles and spiders at this altitude are particularly important, with several nationally rare and scarce species living in wet moss or under stones on mountain tops. Species of nature conservation significance in the montane areas of England are shown in Table 5.7. Further species which occur in montane areas but are more abundant at lower altitudes are covered in other chapters, for example, the nationally scarce mountain ringlet butterfly *Erebia ephiphron* (Chapter 6 Moorland).

Many of the montane invertebrate species in Britain exhibit a northern or western distribution and they are probably responding to the wetness and lower temperatures of these regions. This is reflected in their relatively larger populations in Scotland. Some of these species occur almost down to sea level in the far north west. For example, the snowfield ground beetle *Nebria nivalis*, which is restricted to late snow-lie areas and only occurs on Scafell Pike in England, occurs at sea level on Skye.

Alpine lady's mantle

5.5 Habitat and management requirements of montane species

The habitat and management requirements of nationally rare and scarce montane species are shown in Tables 5.1-5.8. For many species, their ecology is poorly understood and therefore very little information is available on their habitat requirements. This in turn makes it difficult to identify the most appropriate management, but some general guidelines have been provided.

Nationally rare and scarce plants of montane areas occur in a range of plant communities and situations, for example, in grassland and mires, on cliff ledges and scree. Many of these species require undisturbed conditions, while others appear to need particular grazing levels.

For many animal species, maintaining montane heath, mire and grassland communities, including their typical, natural diversity of plant species and vegetation structure, will be of benefit. Invertebrates living in moss or undisturbed stony areas will obviously suffer if these habitats are lost.

Yellow mountain saxifrage

Management of montane areas

5.6 Managing montane areas

Natural montane vegetation communities are generally climax types which require minimal management. However, the montane areas of England have been greatly modified by the influence of man. The main management practices conducted are grazing and burning, although management of public access and recreation is becoming increasingly important. These practices, together with the option of no management, are discussed below.

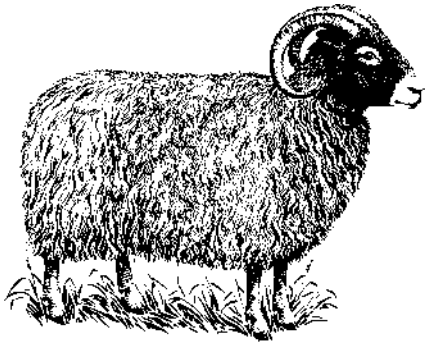
The information included here is only a guide, because the most appropriate management for any given area will depend upon its individual characteristics, as well as the particular farming system involved. Grazing regimes will vary from area to area and will affect the distribution and extent of many plants and animals, as well as the composition and structure of vegetation communities. Changes such as complete removal of stock may be detrimental for some species due to increases in tall vegetation.

Changing management in the montane zone may not always have the desired effect because of changing environmental factors. Global warming, for example, may affect the survival rates and future distribution of montane habitats and species. Nitrogen deposition, which has increased four-fold in some areas over the last 120 years (Lee, Tallis & Woodin 1988), could also exert effects on plant growth and community structure. Here the vegetation is often at the edge of its climatic range and is usually strongly nitrogen-limited (Ineson 1989). In these situations, the benefits of altering management regimes may be limited. For example, reducing grazing with the aim of expanding populations of montane species is unlikely to be successful with populations which are limited by climate. Similarly, attempts to restore montane heath may be unsuccessful if high levels of nitrogen deposition inhibit woolly hair moss regeneration and encourage competing species.

5.6.1 Grazing in montane areas

Montane areas present special problems for grazing because of the slow rate of plant growth. This results in carrying capacities which are lower than on similar areas of lower ground. Montane moss- and lichen-heaths in England and Wales have declined in extent and in their cover of moss and lichens, and this deterioration has corresponded with greater sheep grazing (Jerram 1992; Thompson, Whyte & Oswald 1988).

Sheep are the principal large herbivores found in the montane areas of England. However, a high proportion of vegetation at high altitude is also consumed by invertebrates (Heal & Perkins 1978). The numbers and breed of sheep using montane areas of hill land, in combination with the particular farming system used by the land manager, will influence the impact of the stock on the montane habitats.



Swaledale

Box 5.1 outlines options and techniques for grazing in the montane areas of England, depending on the current condition of the habitat. Where montane habitats have deteriorated owing to heavy grazing, recovery of moss- and lichen-heath will be dependent on the removal of sheep and any other large herbivores (D. Ratcliffe, pers comm). Once this vegetation has recovered, any return to stock grazing must be at sustainable levels if further damage is to be avoided. Maintaining certain areas of montane habitat permanently free of stock grazing is also an option.

Control of livestock movement, as well as numbers, is important in achieving appropriate grazing management in the montane zone. Regular shepherding is now very rare, but can help to spread the grazing pressure across an area. These areas are frequently grazed as part of a larger management unit. Although in practice stocking levels are often much lower at the montane level, sheep may still congregate locally on montane turves and damage the vegetation. Areas favoured by sheep include sheltered valleys and hollows and more palatable grassland such as on limestone. Animals may create bare ground where they concentrate, cause accelerated erosion, trample and damage vegetation and form bare tracks or trails. Where these tracks or 'trods' form near watering places they can act as drains leading to the drainage of wetlands. Local nutrient enrichment from urine and dunging can also occur where sheep gather.

Walling or fencing may be required to control stock numbers and movement. New stock proof boundaries require careful planning in montane areas to avoid conflict with landscape and public access objectives, as well as agricultural uses (see Information Note 7). Small fenced areas can be useful for monitoring the effects of removing or reducing grazing. Fencing larger areas, for example around or immediately below cliffs and rocky outcrops, may allow plants confined to these areas by grazing to spread further afield (see Figure 5.1). Temporary seasonal fencing on areas of turf is another option and allows plants to flower and set seed.

Where montane moss- and lichen-heaths and dwarf shrubs remain but local grazing pressure has reduced their cover, reducing grazing could have considerable benefits for montane species. Substantially reducing or removing grazing altogether may be desirable to allow remaining vegetation to at least stabilise and preferably improve in quality and extent. In the longer term, moderate grazing may be beneficial in promoting or maintaining preferred habitat mosaics and structures (R. Fuller, pers comm). However, reversing severe vegetation changes in montane areas of England may be extremely difficult, especially since they have been exacerbated by nitrogen deposition (Fuller 1996).

Further information:
Marrs & Welch 1991
Chapter 10 Crags, scree and limestone pavement
Information Note 1 Assessing vegetation condition in the English uplands
Information Note 2 Sheep breeds of the English uplands and their characteristics
Information Note 3 Sheep farming systems of the English uplands
Information Note 7 Fencing in the uplands

Box 5.1 Options for grazing in montane areas of England

To maintain vegetation in favourable condition
(See Information Note 1 to determine vegetation condition)

Maintain current grazing practices

- Provided grazing practice has not recently altered and is not causing a deterioration of the habitat.
- Remember that recent alterations may take several years to manifest themselves as a cause of habitat deterioration.
- As a guide, maximum stocking rates should not exceed 0.5 sheep / ha in summer, and in winter the whole flock should be removed from montane areas. Lower summer rates may be desirable in some areas, eg where dotterel nest.
- Favourable condition may also result from a complete absence of stock grazing.

Shepherd sheep to ensure the area is grazed evenly, or as desired.

- Consider incentives for shepherding where it is not currently practised.
- Consider concentrating shepherding effort at particular seasons.

Do not feed stock on montane habitats.

- Feed is generally only required in winter when most stock should be off montane areas.
- Feed may be used at lower altitudes on areas of no conservation interest, such as species-poor acid grassland, to assist in influencing grazing patterns on the management unit as a whole.

To bring vegetation into favourable condition

Where vegetation is unfavourable because of heavy grazing:
Off-winter stock from September to May-June.

- Stock are often removed from the hill or kept down below montane areas from October-November until after lambing in May or June, depending on the weather conditions. Montane habitats are particularly susceptible to grazing damage in the spring and autumn and would benefit from reduced grazing at these times.
- Consider additional sheep housing to facilitate increased off-wintering.
- Consider additional away-wintering to facilitate off-wintering. This involves stock leaving the farm and spending the winter on lower ground.

Reduce grazing

- Reduce grazing to 0.5 sheep / ha or less in summer, and in winter remove the whole flock from montane areas.

To bring vegetation into favourable condition where the above practices do not bring sufficient improvement

Remove grazing temporarily

! Small plots illustrate the effects of removing grazing and are useful for monitoring purposes.
! Larger areas allow a return to a more natural state, increasing overall habitat and species diversity.
! A range of grazing regimes across an area, from none to a variety of lightly grazed states, may provide maximum diversity.
! Only return stock to excluded areas when the vegetation has recovered, and at a lower stocking level than had previously caused the vegetation to deteriorate.

Remove grazing permanently

! Establish areas with no stock grazing, to allow recovery and enhance biodiversity, where appropriate in the context of the surrounding land and its management.

Introduce wethers (castrated male sheep) as a proportion of the flock.

! Consider incentives to encourage this practice, because wethers help to establish the territories of flocks and prevent other flocks encroaching on to their area of the hill. They also eat coarser vegetation, such as mat-grass *Nardus stricta* and heath rush *Juncus squarrosus*, and help to reduce its dominance.

Figure 5.1. Fencing around or immediately below cliffs and rocky outcrops may allow plants confined to these areas by grazing to spread farther afield. The position of the fence is critical as stock, particularly sheep, may be able to find their way into the exclosure by indirect routes! Fences can be permanent or temporary. Fence design should also allow for the easy removal of stock that find their way into the exclosure

Effects of grazing on montane communities and species

Montane plant communities are both changed and damaged by excessive stocking. It may alter the vegetation structure, eliminate plant species, change the plant community or remove the vegetation altogether. For example, sheep grazing increases the cover and frequency of grasses at the expense of lichens, mosses and other montane species such as stiff sedge. Continued heavy grazing can remove even the grass dominated communities and lead to bare ground. Maintaining plant diversity and cover is necessary to provide the appropriate habitat for many montane species, as well as helping to prevent soil erosion.

Moss- and lichen-heaths are not particularly palatable to grazing animals but over-stocking, good weather and feeding of sheep by tourists on regularly visited summits may encourage high numbers of sheep to congregate on mountain tops and utilise these habitats. Grazing animals also move to higher ground to escape being pestered by insects and to feed on the nutritious new growth which occurs later at higher altitudes. The demise from England and Wales of moss-heath has corresponded with increased sheep grazing (Thompson, Whyte & Oswald 1988).

Tall-herb communities and many of the **rarer montane and alpine plants** are restricted in their distribution to places out of reach of the mouths of herbivores. These are usually rocky habitats such as cliff faces and ledges or enclosed ravines and gills. Most tall herbs are palatable to grazing animals and, therefore, these communities can be eliminated by heavy grazing. Reduction or removal of grazing pressure in areas supporting herb-rich communities may be desirable in some places, in order to allow these plants to spread from their current refuges.

Further information: Chapter 10 Crags, scree and limestone pavement.

Bird populations in the montane zone are likely to be lost if the habitat deteriorates through, for example, heavy grazing or greater acidification. Loss of montane moss-heaths, for example, is ornithologically significant because dotterel *Charadrius marinellus* and ptarmigan *Lagopus mutus* are closely associated with the habitat. Dotterel may have been deterred from breeding in England by the loss of moss-heath communities (Galbraith *et al* 1993a & b; Thompson, Whyte & Oswald 1988; Thompson & Brown 1992).

Grazing can also adversely affect the breeding success of birds by trampling their nests and chicks. For example, there may be significant trampling effects on dotterel nests at stocking rates as low as 0.2 sheep / ha (A. MacDonald, pers comm).

Invertebrates suffer detrimental effects from heavy grazing pressure in montane areas. It leads to the loss of some plant species which may be important for shelter or food for invertebrates, such as woolly hair moss, ericoids, golden-rod *Solidago virgaurea* and saxifrage species. It also reduces the structural diversity of the habitat, with detrimental effects on the invertebrate fauna. In addition, extensive trampling by stock (and humans) on mountain summits disturbs stones and small boulders which provide important cover for beetles and spiders.

5.6.2 Burning in montane areas

Burning in the montane zone is uncommon and where it does occur it often arises from fires at lower altitudes being allowed to burn too far up hill or out of control. Burning is damaging to the nature conservation interest of montane habitats because recovery rates in this environment are extremely slow and erosion is likely to result. The same is true for the burning of blanket bogs at this altitude. There are no benefits from burning in the montane zone, for biodiversity or for agricultural or game management.

5.6.3 Managing public access and recreation in montane areas

Mountains are popular areas for public access and recreation, and are extremely valuable for providing enjoyment and appreciation of the countryside. In some areas, visitor pressure may disturb animal populations, trample the vegetation or cause erosion, because the soils and plant communities present are fragile and easily damaged. Such effects tend to be localised, but may cause concern for the wildlife and landscape interest of the area.

Protecting this environment and its vegetation is paramount because of the various animal and plant species it supports. Healthy vegetation also minimises erosion at low cost and maintains the scenic value of the area. In the often fragile soils of montane areas, vegetation helps to reduce the movement of sediments into water courses. Large sediment loads in water courses can cause damage in lower areas and impair water quality, both important aspects for aquatic life, reservoirs and people.

Measures such as footpath and bridleway repair can be employed to minimise adverse effects of activities such as walking, fell running and mountain biking (see Information Note 10). Other techniques may be required for some activities, such as rock climbing (see Chapter 10). Informing the public of the interest of montane areas and about ways to minimise the adverse effects of their visit would also be beneficial.

Further information: Countryside Commission & Countryside Council for Wales 1997; Scottish Natural Heritage 1997; Sports Council & Countryside Commission 1995; Chapter 10 Crags, scree and limestone pavement; Information Note 10 Managing public access and footpaths in the uplands; Figure 5.2.

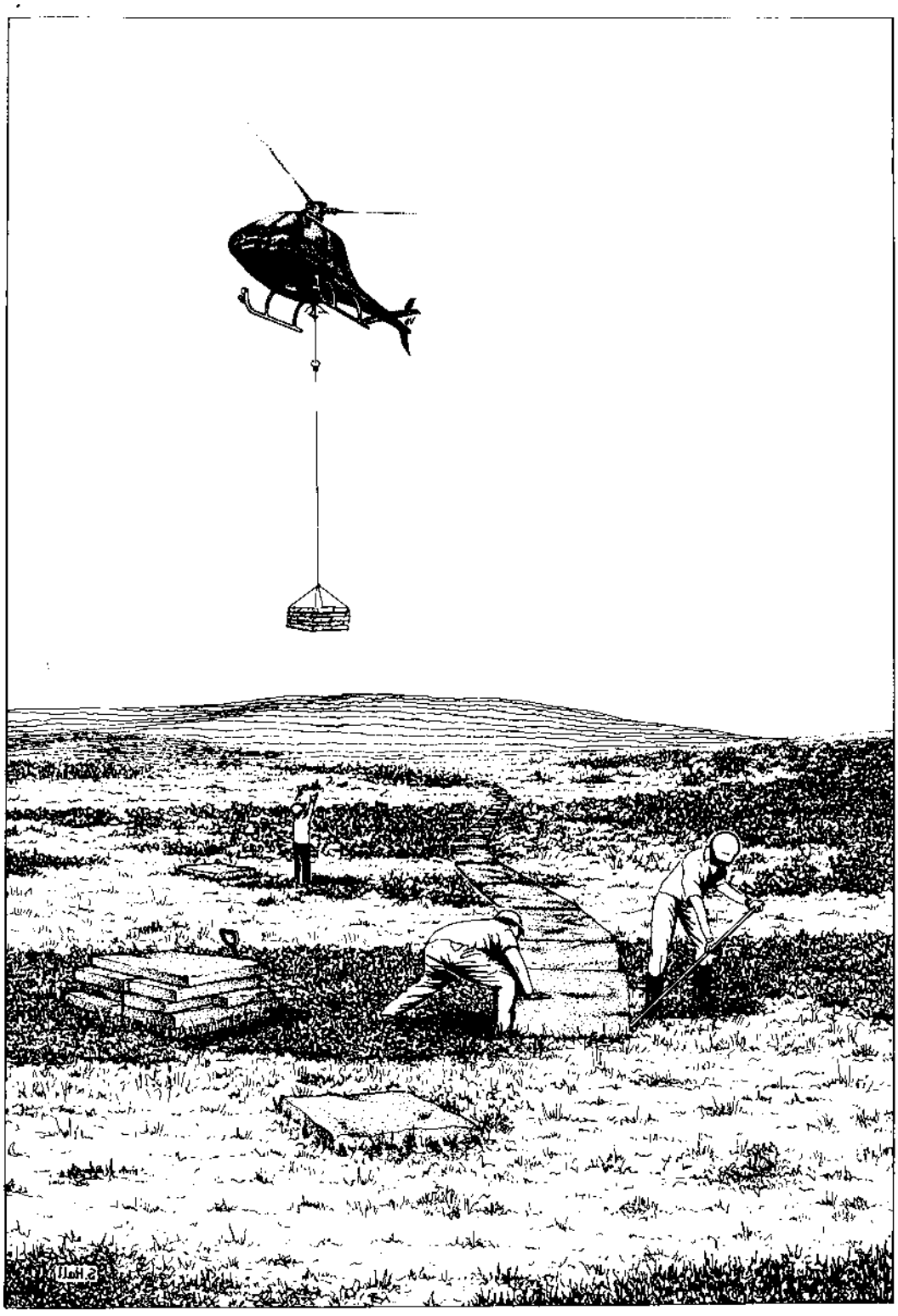


Figure 5.2. Stone flags have been used to surface footpaths over peat in montane areas in the North Pennines and Cheviot Hills. The material used for the flags should be compatible with the geology of the area. The flags float on the peat surface and provide a smooth walking surface. They allow re-vegetation of the surrounding bare peat and the edges and joints also grow over to make the path less obvious (see Information Note 10).

5.6.4 Earth heritage features and management in montane areas

Montane areas contain a range of earth heritage interests, including periglacial features such as patterned ground including stone polygons, circles and stripes (fossil and modern), fossil solifluction lobes and terraces, frost-shattered bedrock (blockfields), ploughing blocks, nivation processes and earth hummocks (thufurs). Where present, these features have implications for management because some activities, such as heavy grazing or visitor pressure, may damage or destroy them. Care should be taken not to disturb features during footpath maintenance and paths can be directed away from fragile features.

Further information: Chapter 4 Earth heritage features; King 1976; O'Halloran *et al* 1994.

5.6.5 Archaeological and historical interests and management in montane areas

Montane areas contain archaeological and historical features such as trackways, beacons, cairns, and enclosures. These have implications for management, such as taking care not to disturb or destroy features during footpath maintenance, and directing paths away from fragile features. English Heritage and County Archaeologists hold records of important sites and features and can be contacted for further information and advice.

5.7 Techniques to restore montane habitats

Recovery of the shrub, moss- or lichen-rich heaths found in the montane zone, such as heather *Calluna vulgaris* or bilberry and lichen *Cladonia arbuscula* heath, is very slow, but recovery is possible if the disturbance ceases (Thompson *et al* 1987). The most obvious option to aid recovery is temporary or permanent removal of grazing, and in some cases management of public access (see 5.6) .

Damage and rehabilitation of ground in mountain areas has been studied in Scotland (Bayfield 1976, 1979, 1980, 1985, 1987; Bayfield & Brown 1985; Bayfield *et al* 1981, 1988). Techniques such as laying stone aggregates on some heavily used footpaths can reduce damage. For badly damaged areas, proposals include the use of mulches and soil stabilizers, repeated applications of nitrogenous fertilizer, sowing with macerated moss fragments and establishment with native species, as well as exclusion of grazing animals (Miller 1986). Other examples include restoration of bared and disturbed ground on Great Dun Fell in Cumbria and in the Cairngorm Mountains (Anderson & Radford 1988).

Further information: Bayfield & Miller 1988; Gilbert et al 1997; Information Note 10 Managing public access and footpaths in the uplands

Table 5.1 Nationally rare and scarce vascular plants associated with montane areas in England

(Note: Some of these species have a broad altitudinal range and also occur in sub-montane and lowland areas. See also Chapter 10 for species predominantly of crags, scree and limestone pavement, and Chapter 6 for species predominantly of sub-montane habitats.)

Plant species	Status	Habitat requirements	Management requirements	Distribution by Natural Area (including those not containing montane areas)
Ajuga pyramidalis pyramidal bugle	LR- ns	In montane areas, ledges of steep basic rock. See Table 6.1.	! Protect sites from habitat destruction.	Cumbria Fells and Dales
Alchemilla minima an alchemilla	VU, EE Priority	In montane areas, very short turf of base-rich *Festuca ovina* grassland amongst limestone boulders and debris. See Table 6.1.	! Maintain grazing. ! Protect sites from habitat destruction. ! See Species Action Plan (UK Biodiversity Group 1998)	North Pennines Yorkshire Dales
Alopecurus borealis Alpine foxtail	LR-ns	In oligotrophic mountain springs and flushes, often associated with late snow-beds, usually in the centres of flushes with percolating water. Found over a wide range of acidic or slightly basic substrates. It is vulnerable to heavy grazing and inflorescences may be most common on drier ground amongst taller vegetation which protects the plants from grazing.	! Protect populations from heavy grazing and from damage by trampling.	Border Uplands North Pennines
Betula nana dwarf birch	LR-ns	Wet upland heaths and blanket bogs on ground varying from moderately dry and sloping to completely flat and waterlogged.	! Protect populations from heavy grazing and burning, although judicious burning may improve seedling establishment. [1]	Border Uplands North Pennines
Carex atrata black Alpine-sedge	LR-ns	Scattered tufts or small clumps in dry and moist places on ungrazed faces and ledges of calcareous cliffs.	! More information is needed about the precise requirements, but it is likely that cessation of grazing may be required if the small populations are to increase.	Cumbria Fells and Dales

Plant species	Status	Habitat requirements	Management requirements	Distribution by Natural Area (including those not containing montane areas)
Carex capillaris hair sedge	LR-ns	A strict calcicole growing on limestone in short herb-rich grassland, closed marshes with low vegetation, open hummocky marshes and flushes and on steep rock faces and ledges. It can grow in very open boreal woodland. Although it is intolerant of competition from taller plants it grows well in short swards and withstands moderate grazing. Heavy grazing or the application of fertilisers to pasture may damage populations.	! Control grazing to moderate levels. ! Prevent the enrichment of surface waters or soil by fertilisers.	Cumbria Fells and Dales North Pennines Yorkshire Dales
Cerastium alpinum Alpine mouse-ear	LR-ns	On ledges, scree and in base-rich grassland, always on a substrate rich in bases such as calcium.	! Protect sites from habitat destruction. ! Protect populations from heavy grazing and burning.	Cumbria Fells and Dales
Circaea alpina Alpine enchanter's-nightshade	LR-ns	Open and usually shaded or north-facing seepage areas and stream sides. See Table 8.1.	! Protect sites from habitat destruction.	Cumbria Fells and Dales North Pennines White Peak Yorkshire Dales
Dryas octopetala mountain avens	LR-ns	Relatively exposed sites on basic rocks, where the soil is not too deep and the drainage is very good.	! Protect sites from erosion and grazing.	North Pennines Yorkshire Dales Cumbria Fells and Dales
Euphrasia frigida	LR-ns	On damp to wet, usually rather basic, ledges.	! Protect sites from habitat destruction. ! Protect populations from heavy grazing and burning.	Cumbria Fells and Dales

Plant species	Status	Habitat requirements	Management requirements	Distribution by Natural Area (including those not containing montane areas)
Gentiana verna spring gentian	Sched. 8 of WCA LR-nt SCC	Upland limestone grassland, usually with short turf. Also sometimes on hummocks in turfy marshes. Growth and reproduction are suppressed by heavy grazing in spring or summer but plants can tolerate grazing in late summer and winter.[2] The species may still be vulnerable to unscrupulous collecting.	! Where possible, control grazing to moderate levels, especially in spring and early summer.	North Pennines
Juncus alpinoarticulatus Alpine rush	LR-ns	Base-rich mires over limestone, usually in open vegetation.	! Protect sites from habitat destruction. ! Protect populations from heavy grazing and burning.	North Pennines Yorkshire Dales
Kobresia simpliciuscula false sedge	LR-nt	Grassland and open gravel flushes of sugar limestone.	! Protect sites from habitat destruction. ! Protect populations from heavy grazing and burning.	North Pennines
Lychnis alpina Alpine catchfly	Sched. 8 of WCA VU SCC	Steep, shattered faces of a high crag of acidic, metalliferous Skiddaw slate, inaccessible to sheep or deer. The species is sensitive to grazing and vulnerable to damage by gully-scramblers. In the past it has been threatened by collecting.	! Access to the site should be controlled. ! Consideration should be given to restricting grazing on potential sites nearby to encourage the spread of this species.	Cumbria Fells and Dales
Lycopodium annotinum interrupted clubmoss	LR-ns	A calcifuge of acidic grassland or heath, in exposed moist but well-drained situations, especially where there is only a thin covering of peat over rock debris, amongst rocks or on wet ravine edges.[3]	! This species requires protection from collecting. ! Protect sites from habitat degradation. ! Some sites may be threatened by heavy grazing, which should be controlled.	Cumbria Fells and Dales
Minuartia stricta Teesdale sandwort	Sched. 8 of WCA EN SCC	Over sugar limestone in open gravelly and stony flushes and eroding margins of sikes, and around the base of hummocks of moss. It is intolerant of competition from other plants.	! Continue to restrict access to the site to prevent damage by trampling visitors.	North Pennines

Plant species	Status	Habitat requirements	Management requirements	Distribution by Natural Area (including those not containing montane areas)
Minuartia verna spring sandwort	LR-ns	On Carboniferous limestone, in semi-open short grassland and among limestone rocks and scree. Also on basic Borrowdale Volcanic rocks. Frequent around old lead and zinc mines. See Table 10.1.	! Protect sites from habitat destruction. ! Where possible, sites should be heavily grazed.	Cumbria Fells and Dales Dark Peak North Pennines Pennine Dales Fringe South West Peak White Peak Yorkshire Dales
Myosotis alpestris Alpine forget-me-not	LR-nt SCC	Heavily grazed limestone grassland on base-rich brown earth soils and rendzinas, sometimes flushed with water from limestone cliffs, usually in semi-open turf. It may be vulnerable to heavy grazing; the failure of one population to flower is thought to be due to grazing in spring.	! Protect sites from habitat destruction. ! Where heavy grazing is thought to be adversely affecting the populations, this should if possible be controlled, especially in spring.	North Pennines
Phleum alpinum Alpine cat's tail	LR-ns	Open, rocky habitats or closed swards on base-rich substrates, usually in damp places. It can thrive under light grazing but heavy grazing appears to have restricted its distribution.	! Protect sites from habitat destruction. ! Where heavy grazing is thought to be restricting the populations, this should if possible be controlled.	Cumbria Fells and Dales North Pennines
Poa alpina Alpine meadow-grass	LR-ns	Steep, open faces of calcareous rocks.	! To allow populations to spread from cliffs, grazing needs to be light.	North Pennines Yorkshire Dales Cumbria Fells and Dales
Poa glauca glaucous meadow-grass	LR-ns	Steep, open faces of calcareous rock and scree. It appears to be sensitive to grazing.	! Protect sites from habitat destruction. ! Where heavy grazing is thought to be restricting the populations, this should be controlled.	Cumbria Fells and Dales

Plant species	Status	Habitat requirements	Management requirements	Distribution by Natural Area (including those not containing montane areas)
Polygala amarella dwarf milkwort	VU	Open sites in short turf over calcareous rocks in well-drained sites. Sometimes in mires, but then on tussocks raised above wetter areas. It is sensitive to heavy grazing.	! Protect sites from habitat destruction. ! Where heavy grazing is thought to be restricting the populations, this should be controlled.	North Pennines Yorkshire Dales Cumbria Fells and Dales
Potentilla crantzii Alpine cinquefoil	LR-ns	Steep, dry rock faces, ledges and grassland over calcareous rocks, in both shaded and sunny aspects. See Table 10.1.	! Populations which are accessible to stock should be protected from heavy grazing.	Cumbria Fells and Dales North Pennines White Peak Yorkshire Dales
Potentilla fruticosa shrubby cinquefoil	LR-nt SCC	In Cumbria, growing on screes and cliffs of loose crumbly rock kept moist by surface water and high precipitation, often on ungrazed ledges. Also on base-rich river alluvium in Teesdale. See Table 10.1.	! Protect sites from habitat destruction. ! Protect from grazing.	Cumbria Fells and Dales North Pennines Pennine Dales Fringe
Salix lapponum downy willow	LR-ns	On dry to moist rock faces, usually basic. It is susceptible to grazing, which has confined it to inaccessible cliffs and rocky sites. Male and female plants must be present in adequate proximity for seed to be set.	! Consideration should be given to increasing the chance of populations spreading, by removing grazing and if possible ensuring that there are enough male and female plants to set seed.	Cumbria Fells and Dales
Saxifraga hirculus yellow marsh saxifrage	Sched. 8 of WCA Annex IIb VU Priority	Low-growing, species-rich flush and mire communities, often fed by springs from Carboniferous limestone. It seems to require a moderate amount of grazing to keep down the surrounding vegetation and patches of bare ground in which seedlings can become established. Heavy grazing in summer suppresses flowering; the species can also reproduce vegetatively and seems able to persist for many years without flowering.	! Wherever possible, control grazing to prevent heavy grazing. ! Protect sites from habitat loss and degradation such as by drainage, afforestation or other agricultural improvements. ! See Species Action Plan (UK Steering Group 1995).	North Pennines

Plant species	Status	Habitat requirements	Management requirements	Distribution by Natural Area (including those not containing montane areas)
Saxifraga nivalis Alpine saxifrage	LR-ns	Periodically irrigated rocks or open vegetation on ledges of crags, usually in shaded sites on base-rich rocks. See Table 10.1.	! Protect sites from habitat destruction. ! Protect populations from heavy grazing and burning.	North Pennines Cumbria Fells and Dales
Sedum villosum hairy stonecrop	LR-ns	In stony flushes that are only slightly base-rich, often on rather level ground beside streams amongst species-poor hill grassland or heather moorland.	! Protect sites from damage such as drainage or the effects of fertilisers.	Border Uplands Cumbria Fells and Dales North Pennines Yorkshire Dales.
Thlaspi caerulescens Alpine penny-cress	LR-ns	High calcareous rocks of the Cumbrian fells. Also a pioneer colonist of metalliferous mine wastes and river gravels. See Table 10.1.	! Protect sites from habitat destruction. ! Where possible, sites should be heavily grazed.	Border Uplands North Pennines Cumbria Fells and Dales White Peak Yorkshire Dales
Viola rupestris Teesdale violet	LR-nt	In open turf on limestone. See Table 6.1.	! Ensure sufficient grazing to keep a short, open turf.	Cumbria Fells and Dales North Pennines Yorkshire Dales
Woodsia ilvensis oblong woodsia	Sched. 8 of WCA LR-nt Priority	Amongst hard, neutral igneous rocks.	! Populations of this species have been damaged by collecting in the past and are still considered to be vulnerable. Site confidentiality should be maintained. ! See Species Action Plan (UK Biodiversity Group 1998).	Cumbria Fells and Dales

Key to Table 5.1

Annex IIb - listed on Annex IIb of the EC Habitats and Species Directive

Sched. 8 of WCA - listed on schedule 8 of the Wildlife & Countryside Act.

Red list categories

CR	- critically endangered
EN	- endangered
VU	- vulnerable
DD	- data deficient
LR -nt	- Lower risk-near threatened
LR-ns	- Lower risk-nationally scarce
E	- endemic to Great Britain
EE	- endemic to England.

Biodiversity Action Plan (BAP)

Priority	- Priority species from UK Steering Group 1995 and UK Biodiversity Group 1998.
SCC	- Species of conservation concern from UK Steering Group 1995 and UK Biodiversity Group 1998.

Sources

Most information from Stewart, Pearman & Preston 1994, Wigginton 1999., Hodgetts, Palmer & Wigginton 1996 and Porley & McDonnell 1997.

1. A. MacDonald, pers comm. 2. I. Taylor, pers comm. 3. Page 1982.

Table 5.2 Nationally rare and scarce bryophytes associated with montane areas in England

(Note: Some of these species have a broad altitudinal range and also occur in sub-montane and lowland areas. See also Chapter 10 for species predominantly of crags, scree and limestone pavement, and Chapter 6 for species predominantly of sub-montane habitats.)

Plant species	Status	Typical habitat	Distribution by Natural Area (including those not containing montane areas)
Amblyodon dealbatus	LR-ns	A calcicole of wet, open ground. On hills and mountains it occurs on tussocks in tufa springs and on stream banks, cliffs and gravel where flushed by calcareous water.	Border Uplands North Pennines Yorkshire Dales Cumbria Fells and Dales
Amblystegium jungermannioides	LR-ns	Damp basic rocks often in woodlands but also on montane rocks. See Table 8.2.	Yorkshire Dales White Peak
Amphidium lapponicum	LR-ns	Base-rich montane cliffs and crags, both on exposed rocks and in gullies, occasionally descending to lower altitudes in ravines and on stream-banks. It usually forms small isolated tufts in rock crevices and is indifferent to rock type provided there is adequate base-enrichment.	Cumbria Fells and Dales
Andreaea frigida	VU Priority	On wet, acid rock, flushed or periodically immersed.	Cumbria Fells and Dales
Andreaea mutabilis	LR-ns	On periodically to more continuously wet, more or less exposed acid boulders, crags or rubble (granite, andesite, basalt, quartzite); rarely on thin soil over rock.	Cumbria Fells and Dales
Anomobryum filiforme var. *concinnatum*	LR-ns	Dry earthy, often crumbling ledges of sun-exposed basic rocks. See Table 10.2.	Border Uplands Yorkshire Dales
Aplodon wormskjoldii	LR-ns	As pale green tufts or patches on dung in wet peaty places at high altitudes.	North Pennines

Plant species	Status	Typical habitat	Distribution by Natural Area (including those not containing montane areas)
Barbilophozia lycopodioides	LR-ns	Base-rich rocks at high altitude.	Border Uplands North Pennines Yorkshire Dales
Barbula icmadophila	LR-nt	Base-rich montane ledges.	Cumbria Fells and Dales
Brachydontium trichodes	LR-ns SCC	Rocks and cliffs. See Table 10.2.	Cumbria Fells and Dales North Pennines South West Peak
Bryum elegans	LR-ns	In dense red-green tufts on limestone rocks and in rock crevices, occasionally in thin limestone turf and on calcareous walls. See Table 10.2.	Forest of Bowland Yorkshire Dales
Bryum weigelii	LR-ns	As pink or greenish-pink patches in mountain springs and flushes, by snow patches and streams, avoiding lime.	Yorkshire Dales Cumbria Fells and Dales Shropshire Hills
Calypogeia integristipula	LR-ns	Montane and lowland rocks. See Table 10.2.	Border Uplands North Pennines South West Peak Yorkshire Dales
Catoscopium nigritum	LR-ns	Mountain ledge communities.	North Pennines
Conostomum tetragonum	LR-ns	On windswept summits and on humus over rock in north-east facing corries.	Cumbria Fells and Dales
Dicranoweisia crispula	LR-ns	Dry acidic rocks, usually in open sunny situations, often on boulders where it is sometimes the only bryophyte. In the Lake District it grows with *Cryptogramma crispa*.	Cumbria Fells & Dales

Plant species	Status	Typical habitat	Distribution by Natural Area (including those not containing montane areas)
Ditrichum zonatum var. *zonatum*	LR-ns	On acid skeletal soils and rocks on a mountain ridge. Particularly characteristic of hepatic mat communities of late snow-beds and flushes in relatively sheltered situations with north and east aspects.	Cumbria Fells and Dales
Encalypta alpina	LR-ns	Small tufts in dry or seasonally moist rock crevices and cliff-faces of limestone, calcareous schist or crumbling calcareous basalt. Favours, but is not restricted to N- or E-facing cliffs.	Yorkshire Dales
Encalypta ciliata	LR-ns	Dry or periodically damp, shaded crevices or cliff-faces of calcareous montane cliffs usually of limestone, calcareous schist, basalt, volcanic tuff or other basic igneous rocks. Also in shaded crevices on rock walls of Carboniferous limestone ravines and gills. Associated with high altitude woodland communities. Always in small quantity and seemingly indifferent to aspect.	Cumbria Fells and Dales Yorkshire Dales
Encalypta rhaptocarpa	LR-ns	Soft, basic igneous rocks. See Table 10.2.	North Pennines Yorkshire Dales
Eremonotus myriocarpus	LR-ns	On schistose, base-rich flushed rocks and crevices on soft lithosols. Also basic rocks in ravines and streams.	Cumbria Fells and Dales
Glyphomitrium daviesii	LR-ns	Dry, often sun-exposed or periodically irrigated, south or west facing basic igneous rock outcrops and stable block-litters.	Cumbria Fells and Dales
Grimmia atrata	LR-ns	One of the 'copper mosses' forming dark green tufts on the surface and in crevices of moist, sheltered or exposed, acidic heavy-metal-bearing rocks. On cliffs, rock outcrops, in scree and by lakes. See Table 10.2.	Cumbria Fells and Dales
Grimmia elongata	LR-nt	Forming small tufts on damp or dry acidic rocks.	Cumbria Fells and Dales
Grimmia incurva	LR-ns	On exposed acidic rock, mountains summits and block scree.	Border Uplands Cumbria Fells and Dales

Plant species	Status	Typical habitat	Distribution by Natural Area (including those not containing montane areas)
Grimmia montana	LR-ns	On hard, exposed, acidic, siliceous rocks.	Cumbria Fells and Dales Shropshire Hills Dartmoor
Hamatocaulis vernicosus slender green feather moss	Annex IIb DD Priority	Mainly a species of somewhat base-rich springs in upland districts. See Species Action Plan (UK Steering Group 1995).	Cumbria Fells and Dales Shropshire Hills
Hygrohypnum dilatatum	LR-ns	Forms green or yellow-green tufts on rocks in fast-flowing streams and rivers, usually in montane areas but sometimes at low altitude.	Border Uplands Cumbria Fells and Dales
Hypnum hamulosum	LR-ns	A calcicole of sheltered rocks, typically in cool situations with a north or east aspect, often growing directly on vertical rock-faces and also on rock-ledges, in rock crevices and in turf among rocks. See Table 10.2.	Cumbria Fells and Dales
Jungermannia subelliptica	LR-ns	In moist or periodically irrigated habitats in rock crevices, on cliff ledges, on disintegrating rock and on flushed gravelly banks and soil. Usually in base-rich situations but not confined to them. See Table 10.2.	Border Uplands Cumbria Fells and Dales Exmoor and the Quantocks Forest of Bowland
Kiaeria blyttii	LR-ns	Sides and tops of boulders in lightly sheltered block screes and on large boulders in streams above normal flood level, most frequently above 500 m.	Border Uplands Cumbria Fells and Dales North Pennines
Kiaeria falcata	LR-ns	Chionophilous communities, late snow lie, boulders and summit ridges.	Cumbria Fells and Dales

Plant species	Status	Typical habitat	Distribution by Natural Area (including those not containing montane areas)
Kiaeria starkei	LR-ns	Characteristic of late-snow areas, where it may grow on near-horizontal slabs, but more often occurs on detrital soils, especially where a thin layer of grit lies over sloping rocks at the foot of crags; also between larger stones and boulders in gullies and in block-screes. On most types of rock except limestone and the most acid rocks.	Cumbria Fells and Dales
Lophozia heterocolpos	LR-ns	Usually on damp calcareous rock outcrops in ravines, on stream sides and on shaded cliffs, typically creeping over cushions of other bryophytes. See Table 10.2.	North Pennines Yorkshire Dales
Lophozia opacifolia	LR-ns	On wet and dripping rocks in gullies and block-screes, especially by waterfalls, springs and flushes and on irrigated gravel and soil by streams, by lakes and in areas of late snow. It favours cool shaded north to east aspects.	Cumbria Fells and Dales
Lophozia wenzelii	LR-nt	In and beside springs, pools and flushes and on wet rocks, especially in areas of late snow.	Cumbria Fells and Dales
Marsupella adusta	LR-ns	Screes, exposed fell-fields, ridges, summits, stream sides, flushes and loch margins. Small stones of granite are the favoured substrate, more rarely basic schists or basalt. Less typically on moist rock-walls and slabs and rarely on moist gravel soil amongst rocks.	Cumbria Fells and Dales
Marsupella boeckii var. stableri	LR-ns	Forming distinctive purplish-brown or coppery mats on periodically flushed montane acid rock walls, boulders and gravelly soil, usually on north- to east-facing slopes and often in gullies.	Cumbria Fells and Dales
Marsupella sphacelata	LR-ns	A calcifuge of montane habitats such sheltered north- or east-facing gullies, where it grows on wet rock-slabs and boulders in and by streams and flushes.	Cumbria Fells and Dales

Plant species	Status	Typical habitat	Distribution by Natural Area (including those not containing montane areas)
Meesia uliginosa	LR-ns	Calcicole of wet, open ground, on seeping rocks, gravel and tufa in the mountains.	Border Uplands North Pennines Cumbria Fells and Dales
Oedipodium griffithianum	LR-ns	In loose, pale green tufts or as scattered plants on moist humus-rich soil in shady rock crevices and in block screes in mountain regions.	Cumbria Fells and Dales Border Uplands North Pennines
Oncophorus virens	LR-ns	On damp calcareous turf, especially in flushes and close to streams, often mixed with other species. Less often it occurs on base-rich rock faces.	North Pennines Cumbria Fells and Dales
Orthothecium rufescens	LR-ns	Occurs most frequently as dense, red, silky patches on damp, periodically flushed, north to east facing steep, often vertical, sheltered montane cliff-faces of limestone, volcanic or other basic rocks. Also on damp, shaded limestone walls of low-lying ravines and more rarely on the sides of turfy tufaceous hummocks in calcareous 'rich-fens' and springs.	Yorkshire Dales Cumbria Fells and Dales
Paraleptodontium recurvifolium	LR-nt	In more or less pure tufts or scattered among other plants on and at the base of cliffs, on rock ledges and banks and in rock crevices, often where water drips from above or within the spray zone of a waterfall. The aspect is usually between north and east and the substrate is probably always base-enriched.	Cumbria Fells and Dales
Plagiothecium cavifolium	LR-ns	On moist, basic mountain rock-ledges, where it may be associated with a wide variety of other calcicoles. Less often on siliceous rock-ledges at lower altitudes, sometimes where the basic influence is only slight.	Cumbria Fells and Dales Yorkshire Dales
Plagiothecium denticulatum var. *obtusifolium*	LR-ns	Among boulders and in rock crevices on mountains, where it is often a component of the vegetation of high-level boulder fields and late-lying snow patches. It also occurs in crevices on calcareous rock-ledges, usually on north- or east- facing cliffs.	Bodmin Moor Cumbria Fells and Dales Yorkshire Dales

Plant species	Status	Typical habitat	Distribution by Natural Area (including those not containing montane areas)
Pohlia elongata ssp. *polymorpha*	LR-ns	On skeletal peaty or gritty soils on rock-ledges, in crevices and occasionally on rocky stream-banks. It also grows on soil amongst boulders on mountain summits.	Cumbria Fells and Dales
Pohlia ludwigii	LR-ns	On moist or wet, sandy and gritty soils on banks and by streams. Also locally frequent in montane bryophyte springs	Cumbria Fells and Dales
Pseudoleskeella catenulata var. *catenulata*	LR-ns	Forms dense, dark- or olive-green patches on calcareous rocks. Prefers dry, open sites, often south facing, where there is little competition.	North Pennines Yorkshire Dales
Pterigynandrum filiforme	LR-ns	Forming neat yellow-green, green or brown mats on open sites in the mountains, on basic rocks or, rarely, branches and roots of trees.	Border Uplands Cumbria Fells and Dales
Racomitrium elongatum	LR-ns	On sandy or gritty soils. See Table 6.2.	Border Uplands Cumbria Fells and Dales
Racomitrium sudeticum	LR-ns	On dry or moist acid rocks, occasionally on soil in the mountains.	Cumbria Fells and Dales Dark Peak Dartmoor North Pennines Yorkshire Dales
Rhabdoweisia crenulata	LR-ns	Rocks from sea-level to high altitudes. Also associated with high altitude woodland communities. See Table 10.2.	Border Uplands Cumbria Fells and Dales Yorkshire Dales
Rhytidium rugosum	LR-ns	Calcicolous species of dry, short and often rather open grassland and turf on well-drained shallow rendzina soils developed over a range of substrates. Also occurs on dry south to south-west facing rock ledges.	North Pennines Yorkshire Dales Cumbria Fells and Dales White Peak

Plant species	Status	Typical habitat	Distribution by Natural Area (including those not containing montane areas)
Scapania aequiloba	LR-ns	On well-drained, strongly calcareous substrates, especially schists and limestones, often in rather exposed situations, such as mountain cliff-ledges, boulders and mossy turfs, but also on rocks in ravines. Less common in moister places such as boulders in streams and flushes.	Border Uplands Cumbria Fells and Dales North Pennines Yorkshire Dales
Scapania cuspiduligera	LR-ns	Forming small whitish-green patches on damp calcareous rocks in shady ravines and on rocks and detritus on stream sides, montane cliffs and rocky gullies. Also on soil and schistose gravel. Limestone and basic schist are the usual substrates but it is also recorded from Old Red Sandstone conglomerate and from Millstone Grit where subject to basic seepage or flooding.	Dark Peak North Pennines Yorkshire Dales
Scapania degenii	LR-ns	A strict calcicole favouring substrates derived from basic schist and limestone, in and beside stony flushes and on wet rock ledges and cliffs.	Cumbria Fells and Dales
Scapania ornithopodioides	LR-ns	As scattered stems amongst other bryophytes or as pure dark reddish-brown patches at moderate to high altitudes in mossy block-screes, on rocky well-drained slopes. Most common on acid substrates on open slopes or in mountain corries with a north to east aspect, where shade and humidity are maintained. It is a characteristic member of the 'hepatic mat' community.	Cumbria Fells and Dales
Scapania paludosa	LR-ns	In high altitude neutral to mildly basic bryophyte-dominated springs and flushes, and on wet rocks in gullies.	Cumbria Fells and Dales
Scapania uliginosa	LR-ns	High altitude springs and flushes, often submerged or emergent, usually in acid to neutral oligotrophic water. Also on wet rocks in late snow areas, in boggy ground, on lake shores and on constantly irrigated rocks on dripping cliffs and in shaded gullies.	Cumbria Fells and Dales North Pennines
Schistidium trichodon	LR-ns	Dry, often south- or west-facing, or seasonally damp limestone, calcareous schist or volcanic tuff cliffs.	North Pennines

Plant species	Status	Typical habitat	Distribution by Natural Area (including those not containing montane areas)
Sphenolobopsis pearsonii	LR-ns	In minute appressed green to blackish mats or as scattered stems on damp shaded rock-walls and boulders in sheltered ravines, on large blocks in scree and on vertical rock-walls on montane cliffs with a north to east aspect. Rocks are usually acid, eg granite and gneiss. Also associated with high altitude woodland communities. The plants may grow directly on rock or on a thin peaty, or mossy crust, sometimes with filamentous algae.	Cumbria Fells and Dales
Splachnum vasculosum	VU	In pale green loose patches on dung in springs and flushes at high altitudes.	Border Uplands North Pennines Cumbria Fells and Dales
Tomentypnum nitens	LR-ns	Open calcareous mires, flushes and wet fields, sometimes on gentle slopes flushed by water from steeper ones, at pH 5.8 or more.	Border Uplands Cumbria Fells and Dales North Pennines South West Peak Yorkshire Dales
Tetralophozia setiformis	LR-ns	Forming conspicuous mats, sometimes in quantity, on dry granite rocks and soil and amongst boulder scree, also rarely on tree roots.	Border Uplands

Key to Table 5.2

Annex IIb	- listed on Annex IIb of the EC Habitats and Species Directive
Sched. 8 of WCA	- listed on schedule 8 of the Wildlife & Countryside Act.

Red list categories

CR	- critically endangered
EN	- endangered
VU	- vulnerable
DD	- data deficient
LR -nt	- Lower risk-near threatened
LR-ns	- Lower risk-nationally scarce
E	- endemic to Great Britain
EE	- endemic to England.

Biodiversity Action Plan (BAP)

Priority	- Priority species from UK Steering Group 1995 and UK Biodiversity Group 1998.
SCC	- Species of conservation concern from UK Steering Group 1995 and UK Biodiversity Group 1998.

Sources

Most information from Hill, Preston & Smith 1991, 1992, 1994, Hodgetts, Palmer & Wigginton 1996 and Porley & McDonnell 1997.

Table 5.3 Habitat and management requirements of bryophytes associated with montane areas in England

Plants	Habitat requirements	Management requirements
Plants of rocks and block-scree	Relatively undisturbed rocks. Block-scree sometimes supports mixed hepatic mat communities (see below).	! Where relevant, protect sites from damage by climbing or trampling.
Plants of montane grassland and skeletal soil amongst rocks	Relatively undisturbed conditions.	! Where relevant, protect sites from damage by trampling.
Communities of Atlantic liverworts	These are related to the Scottish 'mixed hepatic mat' communities, which are very rare in England. Those constituent species which occur in Cumbria are mostly scattered through a variety of habitats, including rocky woodland and steep open rocks.[1] They are sometimes found beneath heathland of senescent *Calluna* and other ericaceous shrubs, or in block-scree. They can be badly damaged by fire.[2]	! Protect sites from burning.

Sources

1. D. Ratcliffe, pers comm.
2. N. Hodgetts, pers comm.

Also Hodgetts 1993b, P. Lambley and R. Porley, pers comm.

Table 5.4 Plant communities associated with montane areas in England (National Vegetation Classification, NVC, Rodwell 1991, 1992)

NVC code	NVC name	Inclusion in Annex 1 of Habitats Directive[1]	Significance in England[2]	Montane Natural Area of England where community occurs[2]
Heaths				
H13	*Calluna vulgaris-Cladonia arbuscula* heath	Alpine & sub-alpine heaths	I	North Pennines Cumbria Fells and Dales
H18 (Also sub-montane - see Ch 6)	*Vaccinium myrtillus-Deschampsia flexuosa* heath	Alpine & sub-alpine heaths Dry heaths	L	Border Uplands Yorkshire Dales Cumbria Fells and Dales North Pennines
H19	*Vaccinium myrtillus-Cladonia arbuscula* heath	Alpine & sub-alpine heaths	L	Border Uplands Yorkshire Dales Cumbria Fells and Dales
H22	*V. myrtillus-Rubus chamaemorus* heath	Alpine & sub-alpine heaths	UK	Border Uplands North Pennines
Mires				
M7	*Carex curta-Sphagnum russowii* mire	-	L	North Pennines
M8	*Carex rostrata-Sphagmum warnstorfii* mire	-	L	North Pennines
M31	*Anthelia julacea-Sphagnum auriculatum* spring	-	L	Cumbria Fells and Dales
M32	*Philonotis fontana-Saxifraga stellaris* spring	-	L	Cumbria Fells and Dales
Grasslands				
U7	*Nardus stricta-Carex bigelowii* grass heath	Siliceous alpine & boreal grassland	L	North Pennines Yorkshire Dales Cumbria Fells and Dales
U10	*Carex bigelowii-Racomitrium lanuginosum* moss heath	Siliceous alpine & boreal grassland	UK	North Pennines Cumbria Fells and Dales
U13	*Deschampsia cespitosa-Galium saxatile* grassland	-	I	Cumbria Fells and Dales
U15	*Saxifraga aizoides-Alchemilla glabra* banks	-	L	Cumbria Fells and Dales

NVC code	NVC name	Inclusion in Annex 1 of Habitats Directive[1]	Significance in England[2]	Montane Natural Area of England where community occurs[2]
U16	*Luzula sylvatica* - *Vaccinium myrtillus* tall herb community. See also Chapter 10 Crags, scree and limestone pavement	-	UK	Border Uplands North Pennines Cumbria Fells and Dales
U17	*Luzula sylvatica-Geum rivale* tall herb community. See also Chapter 10 Crags, scree and limestone pavement.	Eutrophic tall herbs	L	Border Uplands North Pennines Cumbria Fells and Dales Yorkshire Dales
CG11	*Festuca ovina-Agrostis capillaris-Alchemilla alpina* grass heath	Species-rich *Nardus* grassland on siliceous substrates*	UK	Cumbria Fells and Dales

Key

1 From Brown *et al* 1997:
- * Priority habitat

2 From Drewitt & Manley 1997:
- I Internationally scarce with UK representation;
- UK Well developed in the UK but represented elsewhere;
- L Widely developed in Europe.

Table 5.5 Breeding birds associated with montane areas in England

(Note: Some of these species have a broad altitudinal range and also occur in sub-montane and lowland areas. See also Chapters 6-10 for species predominantly of sub-montane habitats.)

Bird species[1]	Birds of conservation concern in the UK[2]	Listed on Schedule 1 of the Wildlife & Countryside Act 1981	Listed on Annex 1 of the EC Birds Directive	No of British 10-km squares with breeding records 1988-90	% of breeding records in upland ITE squares in Britain[3]	Main upland habitat associations	Principal upland Natural Areas supporting the species (including those not containing montane areas) *= major/important areas[4]
Golden eagle *Aquila chrysaetos*	Amber list	!	!	216	88.9	Moorland and montane areas	10* extinct elsewhere
Peregrine *Falco peregrinus*	Amber list	!	!	719	61.6	Moorland and montane areas	4, 8, 10*, 12, 14, 15, 25, 87*, 94
Red grouse *Lagopus lagopus scoticus*	-	-	-	749	78.6	Moorland	2*, 4*, 8*, 10, 12*, 14*, 15*, 17*, 25*, 29, 41, 42, 58(?), 87, 92
Ptarmigan *Lagopus mutus*	-	-	-	133	100	Montane areas	4, 10 but extinct in England
Dotterel *Charadrius morinellus*	Amber list	!	!	48	100	Montane areas	4*, 10
Golden plover *Pluvialis apricaria*	Amber list	-	!	630	84.1	Moorland and enclosed land	2*, 4*, 8*, 10, 12*, 14*, 15, 17*, 25*, 29, 92
Dunlin *Calidris alpina*	Amber list	-	-	353	78.8	Moorland	2, 4*, 8*, 12, 14*, 25*, 94
Meadow pipit *Anthus pratensis*	-	-	-	2,257	38.1	Moorland and enclosed land	All areas
Wheatear *Oenanthe oenanthe*	-	-	-	1,339	60.6	Montane areas, moorland and enclosed land	2*, 4*, 8*, 10*, 12, 14, 15, 17, 25, 29, 30*, 41, 42, 58, 60, 87, 92*, 94
Ring ouzel *Turdus torquatus*	Amber list	-	-	401	93.5	Moorland and scrub	2, 4*, 8*, 10*, 12, 14*, 15(?), 17, 25, 29, 30, 42, 87, 92*

Key to Table 5.5

1. Upland breeding bird species as identified in Stillman & Brown 1998.
2. Birds of conservation concern from RSPB 1996.
3. From Bunce & Barr 1988, using the 13 ITE land classes which were regarded as upland (information not available on an English basis).
4. The following 18 Natural Areas are classed as upland by English Nature:

No	Natural Area name		
2	Border Uplands	29	South West Peak
4	North Pennines	30	White Peak
8	Yorkshire Dales	41	Oswestry Uplands
10	Cumbria Fells and Dales	42	Shropshire Hills
12	Forest of Bowland	58	Clun and North West Herefordshire Hills
14	Southern Pennines	60	Black Mountains and Golden Valley
15	Pennine Dales Fringe	87	Exmoor and the Quantocks
17	North York Moors & Hills	92	Dartmoor
25	Dark Peak	94	Bodmin Moor

Natural Areas containing montane habitats to include the following:

2	Border Uplands	8	Yorkshire Dales
4	North Pennines	10	Cumbria Fells and Dales

Table 5.6 Habitat and management requirements of birds associated with montane areas in England

Montane birds	Habitat requirements	Management requirements
Ptarmigan (extinct in England)	! Nest on the ground in a range of montane plant communities, including *Racomitrium lanuginosum* heaths, but avoid areas of extensive grassland. ! Feed in a range of montane habitats, but with a greater selection for dwarf shrub communities (primarily bilberry *Vaccinium myrtillus* but also crowberry *Empetrum nigrum*). ! Cover in the form of rocks, heavily broken ground and hummocks is also an important feature of habitat selection. ! Flushes and springs are particularly heavily selected by feeding birds, either with or without chicks. ! A mosaic of small patches of dwarf shrub heath, flushes and rock is ideal. ! Chicks feed on invertebrates (mainly flies), the flowers of herbs (eg bedstraw *Galium* spp., alpine lady's mantle *Alchemilla alpina* and saxifrage *Saxifraga* spp.) and bilberry shoot tips. As they grow, invertebrates decrease in importance and dwarf shrubs (eg crowberry) become more important as their diets change to those of adults. ! Present in montane areas all year unless forced to descent by severe weather.	! Maintain and enhance montane dwarf shrub heaths by reducing grazing and encouraging non-intervention areas.
Dotterel	! Prefer flat or gently sloping ground. ! Nest on the ground with strong selection for nesting on woolly hair moss *R. lanuginosum* heaths. ! Areas of bare ground within *R. lanuginosum* heaths (up to 10% cover) important for nesting and feeding adults and chicks. ! Feed mainly on beetles, sawflies and the adults and larvae of crane-flies *Tipula montana*. ! Birds not present in uplands outside breeding season (mid-April – end August).	! Maintain and enhance *R. lanuginosum* heaths and montane dwarf-shrub heaths by reducing grazing and encouraging non-intervention areas. ! Maintain a degree of heterogeneity in the appearance of the habitat as this is important for nesting.

Sources

Ratcliffe 1973, Galbraith *et al* 1993a & b and P. Whitfield, pers comm.

Table 5.7 Nationally rare and scarce invertebrates associated with montane areas in England

Invertebrate species		Nature conservation status	Typical habitat	Distribution in upland England (not currently available in terms of Natural Areas)
Scientific name	**English name**			
Moths				
Catoptria furcatellus	Micro-moth	Nationally Scarce B	Sparse turf at high altitude	Lake District (and a nineteenth century Cheviot record)
Xestia alpicola alpina	Northern dart moth	Nationally Scarce A Priority	Feeds on *Empetrum nigrum* at high altitude	North Pennines. Old records for Lake District and Northumberland
Xestia ashworthii	Ashworth's rustic moth	Nationally Scarce A Priority	On heather and other upland plants (including foxgloves) in montane and moorland areas	Northumberland
Butterflies				
Erebia epiphron	Small mountain ringlet	Nationally scarce B SCC	*Nardus* grassland, from around 400 m upwards	In England it is restricted to the Lake District only occurring at high altitudes.
Beetles				
Aphodius fasciatus	Dung beetle	Nationally Scarce B	Sheep and deer dung at high altitude on moorland and mountain habitats	North York Moors, Lake District and Pennines
Byrrhus arietinus	Pill beetle	Nationally Scarce B	Feeds on *Racomitrium lanuginosum* on moors and mountain tops	Pennines, Derbyshire Peaks, North York Moors and Lake District
Elaphrus lapponicus	Ground beetle	Nationally Scarce A	Wet moss at very high altitude, also by very high streams	Lake District

Invertebrate species		Nature conservation status	Typical habitat	Distribution in upland England (not currently available in terms of Natural Areas)
Eudectus whitei *	Rove beetle	Nationally Scarce A	Under stones and in moss on mountain summits	Only on summits of Three Peaks in Yorkshire Dales, although possibly now extinct there
Geodromicus longipes	Rove beetle	Nationally Scarce B	In *R. lanuginosum* and under stones on mountain tops	Cumbria and perhaps Staffordshire
Leistus montanus	Ground beetle	Nationally Scarce A	Under stones on mountain tops	Lake District
Miscodera arctica	Ground beetle	Nationally Scarce B	Under stones on mountain summits, moors and northern lowland heath	Cumbria, Northumberland, Pennines, North York Moors and Exmoor
Mycetoporus monticola	Rove beetle	Nationally Scarce B	In moss on mountain tops	Cumbria
Nebria nivalis	Ground beetle	Nationally Scarce A	Very cold areas – by late snow-lie beds, north facing gullies at high altitude and frost shattered summits among *Racomitrium* growing between stones	Scafell Pike
Olophrum assimile	Rove beetle	RDBI	Wet moss, litter and stream sides at very high altitude	The only recent GB record is from Dun Fell. Old records in Scotland
Oxypoda soror	Rove beetle	Nationally Scarce B	In moss and under stones on mountain tops	Old records from Skiddaw in Cumbria
Oxypoda tirolensis	Rove beetle	Nationally Scarce B	In moss and under stones on mountain tops	Old records for Scafell and Skiddaw in Cumbria
Stenus glacialis	Rove beetle	RDBK	In wet moss high on mountains	Single old record in England from summit of Cheviot
Spiders				

* Not recorded elsewhere other than the UK, but almost certainly not endemic – is in a poorly understood group of beetles

Invertebrate species		Nature conservation status	Typical habitat	Distribution in upland England (not currently available in terms of Natural Areas)
Entelecara errata	Money spider	Nationally Scarce B	Under stones on mountain tops	Northumberland
Lepthyphantes pinicola	Money spider	Nationally Scarce B	Mainly under stones on mountains but also on moorland	Yorkshire, Cumbria and Staffordshire
Lepthyphantes whymperi	Money spider	Nationally Scarce B	In cavities among rocks on mountains	Lake District
Pardosa trailli	Wolf spider	Nationally Scarce B	Under stones and in scree on mountains	Lake District
Rugathodes bellicosus	Comb-footed spider	Nationally Scarce B	Under stones on high ground (but at sea level in Scotland). Mountain tops and moorland in England	Yorkshire Pennines and the Lake District
Tiso aestivus	Money spider	Nationally Scarce B	Under stones above 600 m	Lake District

Key

RDB	Red Data Book (Shirt 1987; Hyman & Parsons 1992)
RDBI	Red Data Book - Indeterminate
RDBK	Red Data Book - Insufficiently known
Nationally Scarce A	15-30 10-km squares of national grid
Nationally Scarce B	30-100 10-km squares of national grid
Priority	Priority species in the UK Biodiversity Action Plan (UK Steering Group 1995; UK Biodiversity Group 1998)
SCC	Species of conservation concern in the UK Biodiversity Action Plan (UK Steering Group 1995; UK Biodiversity Group 1998)

Table 5.8 Habitat and management requirements of invertebrates associated with montane areas in England

Montane invertebrates	Habitat requirements	Management requirements
Moss-inhabiting species	Moss, especially woolly hair moss *Racomitrium lanuginosum* and moss in flushes and beside streams.	! Maintain minimal grazing and manage recreation on summits. ! Encourage non-intervention areas.
Species living under stones (lapidicolous)	Undisturbed stony areas, fairly stable screes.	! Manage recreation. ! Discourage opportunistic cairn-building by informing the public of the invertebrate interest and potential impacts.
Ground and rove beetles	Bare ground for hunting.	! Usually no necessity for management in montane areas where grazing occurs and paths are present.